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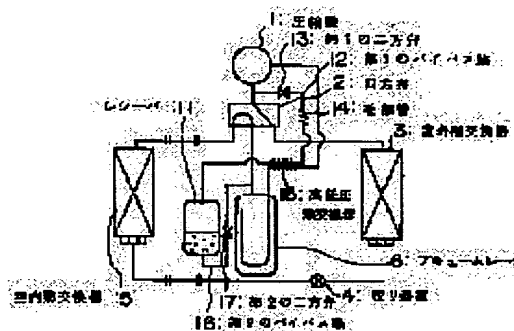
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(54) REFRIGERATION CYCLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a refrigeration cycle capable of restricting a variation of a composition of a circulating refrigerant due to a surplus refrigerant and improving COP even in the case a non-azeotropic refrigerant is used.

SOLUTION: A first two-way valve 13 and a capillary tube 14 for adjusting a refrigerant flow rate are provided, a piping for connecting a compressor 1 to a four-way valve 2 and a first bypass 12 for connecting a receiver 11, a high-low pressure heat exchanger 15 for exchanging heat between a non-azeotropic refrigerant at low pressure from an accumulator 6 to be sucked into a compressor 1 and said refrigerant at high temperature and high pressure passing inside the first bypass 12, and a second two-way valve 17 are provided, and a second bypass 16 for connecting the receiver 11 and the accumulator 6 is provided.



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CLAIMS

[Claim(s)]

[Claim 1] The refrigerating cycle characterized by providing the following. The compressor which forms into elevated-temperature high pressure the non-azeotropy mixing refrigerant which consists of two or more kinds of refrigerants with which the boiling points differ, and is made to circulate through it through a four way valve, a condenser, an collimator, an evaporator, and an accumulator in order Receiver The 1st bypass way which connects piping which the capillary tube which adjusts the 1st two way valve and refrigerant flow rate is prepared, and connects said compressor and four way valve, and said receiver The 2nd bypass way which the heat exchanger which carries out heat exchange, and the 2nd two way valve are prepared in said low-pressure refrigerant of the accumulator inhaled by said compressor, and said refrigerant of the elevated-temperature high pressure passing through the inside of said 1st bypass way, and connects said receiver and accumulator

[Claim 2] Said receiver is a refrigerating cycle according to claim 1 characterized by extending caudad as a dashboard and forming the pars basilaris ossis occipitalis of said accumulator.

[Claim 3] The 1st temperature sensor installed in the discharge side of said compressor, and the 2nd temperature sensor installed in said condenser, The difference of the detection temperature of said 1st temperature sensor and the detection temperature of said 2nd temperature sensor is calculated. And compare the value with the 1st allowed value set up beforehand, and when said value is below a lower limit of the 1st allowed value, said 1st two way valve is changed into an open condition. It is a refrigerating cycle given in claim 1 characterized by having the 1st valve-control means which changes said 2nd two way valve into an open condition when said value exceeds the upper limit of the 1st allowed value, or either of 2.

[Claim 4] The 3rd temperature sensor installed in the inlet side of said compressor, and the 4th temperature sensor installed in said evaporator, The difference of the detection temperature of said 3rd temperature sensor and the detection temperature of said 4th temperature sensor is calculated. And compare the value with the 2nd allowed value set up beforehand, and when said value is below a lower limit of the 2nd allowed value, said 1st two way valve is changed into an open condition. It is a refrigerating cycle given in claim 1 characterized by having the 2nd valve-control means which changes said 2nd two way valve into an open condition when said value exceeds the upper limit of the 2nd allowed value, or either of 2.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to refrigerating cycles, such as an air conditioner which enclosed the non-azeotropy mixing refrigerant which consists of two or more kinds of refrigerants with which the boiling points differ.

[0002]

[Description of the Prior Art] Drawing 8 is the block diagram showing the refrigerating cycle of the conventional air conditioner, and the compressor which 1 inhales and compresses the gas refrigerant of low-temperature low voltage in an accumulator 6, and is used as the gas refrigerant of elevated-temperature high pressure, the outdoor heat exchanger to which a four way valve and 3 operate as a condenser in 2, and 4 are an collimator and indoor heat exchanger to which 5 operates as an evaporator in drawing.

[0003] In air conditioning operation, in the refrigerating cycle of the conventional air conditioner constituted as mentioned above, the gas refrigerant of elevated-temperature high pressure goes into an outdoor heat exchanger 3 through discharge and a four way valve 2 from a compressor 1, for example. Heat exchange of this gas refrigerant is carried out to the open air by the outdoor heat exchanger, it turns into a liquefied refrigerant, and goes into an collimator 4. The liquefied refrigerant is decompressed by the collimator 4, turns into a low two phase refrigerant of a dryness fraction, and is sent into indoor heat exchanger 5. And heat exchange is carried out to air indoor by indoor heat exchanger 5, and it evaporates, it becomes the high two phase refrigerant of a dryness fraction, and is again inhaled by the compressor 1 via a four way valve 2 and an accumulator 6. At this time, the surplus refrigerant which remained in the refrigerant circuit is stored by the accumulator 6.

[0004]

[Problem(s) to be Solved by the Invention] It sets to the above conventional refrigerating cycles. R(chlorofluocarbon)134a 52 % of the weight, Since it is easy to gasify many R32 and R125 which are a low-boiling point refrigerant in the surplus refrigerant stored by the accumulator 6 when the non-azeotropy mixing refrigerant which mixed R125 25% of the weight, and mixed R32 by 23% of the weight of the ratio is used, When the amount of the surplus refrigerant which the refrigerant which circulates through the inside of a refrigerating cycle serves as a presentation of there being more R32 and R125 which are a low-boiling point refrigerant, and is stored by the accumulator 6 changes The presentation of the refrigerant which circulates through the inside of a refrigerating cycle also changed, the physical properties of a circulation refrigerant were changed from this, and fluctuation of working pressure or capacity etc. had arisen.

[0005] Moreover, it is known that the heat transfer rate in heat exchanger piping will become small by the non-azeotropy nature of a mixed refrigerant compared with the single refrigerant of R22 grade used from the former, and the technical problem that COP (effectiveness) of a refrigerating cycle fell by this also occurred.

[0006] Even if this invention was made in order to solve this technical problem, and a non-azeotropy mixing refrigerant is used for it, it aims at offering the refrigerating cycle which can control fluctuation of a presentation of the circulation refrigerant by the surplus refrigerant, and

raises COP.

[0007]

[Means for Solving the Problem] The compressor which the refrigerating cycle concerning this invention forms into elevated-temperature high pressure the non-azeotropy mixing refrigerant which consists of two or more kinds of refrigerants with which the boiling points differ, and is circulated through a four way valve, a condenser, an collimator, an evaporator, and an accumulator in order, The 1st bypass way which connects a receiver, and piping which the capillary tube which adjusts the 1st two way valve and refrigerant flow rate is prepared, and connects said compressor and four way valve and said receiver, The heat exchanger which carries out heat exchange, and the 2nd two way valve are prepared in said low-pressure refrigerant of the accumulator inhaled by said compressor, and said refrigerant of the elevated-temperature high pressure passing through the inside of said 1st bypass way, and it has the 2nd bypass way which connects said receiver and accumulator.

[0008] Said receiver is caudad prolonged as a dashboard and the pars basilaris ossis occipitalis of said accumulator is formed.

[0009] Moreover, the 1st temperature sensor installed in the discharge side of said compressor and the 2nd temperature sensor installed in said condenser, The difference of the detection temperature of said 1st temperature sensor and the detection temperature of said 2nd temperature sensor is calculated. And the value is compared with the 1st allowed value set up beforehand, when said value is below a lower limit of the 1st allowed value, said 1st two way valve is changed into an open condition, and when said value exceeds the upper limit of the 1st allowed value, it has the 1st valve-control means which changes said 2nd two way valve into an open condition.

[0010] Furthermore, the 3rd temperature sensor installed in the inlet side of said compressor and the 4th temperature sensor installed in said evaporator, The difference of the detection temperature of said 3rd temperature sensor and the detection temperature of said 4th temperature sensor is calculated. And the value is compared with the 2nd allowed value set up beforehand, when said value is below a lower limit of the 2nd allowed value, said 1st two way valve is changed into an open condition, and when said value exceeds the upper limit of the 2nd allowed value, it has the 2nd valve-control means which changes said 2nd two way valve into an open condition.

[0011]

[Embodiment of the Invention] Operation gestalt 1. drawing 1 is the block diagram concerning the operation gestalt 1 of this invention showing the refrigerating cycle of an air conditioner, for example, and shows the condition at the time of air conditioning operation. In addition, the sign same identically to the former explained by drawing 8 as a considerable part is attached, and explanation is omitted.

[0012] The 1st bypass way which branched in drawing from piping whose 12 11 connects a receiver and connects a compressor 1 and a four way valve 2, and was connected to the receiver 11, The 1st two way valve to which 13 opens and closes the 1st bypass way 12, the capillary tube which adjusts the amount of the gas refrigerant of elevated-temperature high pressure with which 14 flows on the 1st bypass way 12, The high low voltage heat exchanger which carries out heat exchange for the gas refrigerant of low-temperature low voltage with which 15 is inhaled by the compressor 1, and the gas refrigerant passing through the inside of the 1st bypass way 12 of elevated-temperature high pressure, The 2nd bypass way which 16 branched from inlet-port piping of an accumulator 6, and was connected to a receiver's 11 pars basilaris ossis occipitalis, and 17 are the 2nd two way valve which opens and closes the 2nd bypass way 16. In addition, the refrigerant used for this operation gestalt is a non-azeotropy mixing refrigerant which consists of two or more kinds of refrigerants with which the boiling points differ.

[0013] In the refrigerating cycle constituted as mentioned above, the actuation at the time of air conditioning operation is explained. In addition, the 1st two way valve shall be in an open condition at the time of a start up. The gas refrigerant of elevated-temperature high pressure goes into an outdoor heat exchanger 3 through discharge and a four way valve 2 from a

compressor 1. Heat exchange of this gas refrigerant is carried out to the open air by the outdoor heat exchanger 3, it turns into a liquefied refrigerant, and goes into an collimator 4. The liquefied refrigerant is decompressed by the collimator 4, turns into a two phase refrigerant of low-temperature low voltage of dryness fractions 0.2-0.3, and is sent into indoor heat exchanger 5. And heat exchange is carried out to air indoor by indoor heat exchanger 5, and it evaporates, it becomes the two phase refrigerant of low-temperature low voltage of dryness fractions 0.9-1.0, and is again inhaled by the compressor 1 via a four way valve 2 and an accumulator 6.

[0014] On the other hand, it flows to the direction of the 1st bypass way 12 with open [of the 1st two way valve 13], and passes along a capillary tube 14, and heat exchange is further carried out to the gas refrigerant of low-temperature low voltage inhaled by the compressor 1 with a passage in the high low voltage heat exchanger 15, namely, it is cooled, and some gas refrigerants of elevated-temperature high pressure breathed out from the compressor 1 turn into a high-pressure liquid cryogen, and it is stored by the receiver 11 as a surplus refrigerant.

[0015] Here, presentation change of a surplus refrigerant is explained based on drawing 2.

Drawing 2 is the comparison Fig. of presentation change of the circulation refrigerant when storing a non-azeotropy mixing refrigerant in a receiver and an accumulator. When an excessive non-azeotropy mixing refrigerant is accumulated in the accumulator 6 of a refrigerating cycle like before shown in drawing 8, since the mixed refrigerant is low voltage, presentation change becomes large (refer to I). On the other hand, since the hot surplus mixing refrigerant (liquefied) is stored in a receiver 11 in the case of this operation gestalt, presentation change of the mixed refrigerant which circulates through a refrigerating cycle becomes small (refer to RO).

[0016] In addition, when operational status changes with change of an OAT, an air-conditioning load, etc. and it becomes insufficient [a refrigerant] during steady operation, the 2nd two way valve 17 is changed into an open condition, and the surplus refrigerant stored in the receiver 11 is supplied to an accumulator 6.

[0017] Since it is made to go via the 1st bypass way 12, it cools and some gas refrigerants of elevated-temperature high pressure, i.e., a surplus refrigerant, breathed out from the compressor 1 were stored in the receiver 11 according to the operation gestalt 1 as mentioned above, it can become possible to lose the surplus refrigerant in an accumulator 6, presentation change of the refrigerant which circulates through a refrigerating cycle can also be suppressed small, and fluctuation of working pressure or capacity etc. can be prevented.

[0018] Moreover, since the refrigerant inhaled by the compressor 1 by losing the surplus refrigerant in an accumulator 6 is certainly gasifiable, the effectiveness of a compressor 1 becomes good and it is effective in COP of a refrigerating cycle improving.

[0019] Operation gestalt 2. drawing 3 is the block diagram concerning the operation gestalt 2 of this invention showing the refrigerating cycle of an air conditioner, for example, and shows the condition at the time of air conditioning operation. In addition, the sign same identically to the operation gestalt 1 explained by drawing 1 as a considerable part is attached, and explanation is omitted.

[0020] In the operation gestalt 2, in the pars basilaris ossis occipitalis of an accumulator 6, a receiver 11 is caudad prolonged as a dashboard 18, and is formed, and this dashboard 18 is for carrying out heat exchange of the gas refrigerant of elevated-temperature high pressure led to the receiver 11 to the gas refrigerant of low-temperature low voltage in an accumulator 6. An accumulator 6 and a receiver 11 are connected by the 2nd bypass way 16, and the receiver 11 is connected to piping which connects a four way valve 2 to a compressor 1 through the 1st bypass way 12. The 1st two way valve 13 and capillary tube 14 are prepared in this 1st bypass way 12, and the 2nd two way valve 17 is attached in the bypass way 16 the 2nd.

[0021] Next, the actuation at the time of air conditioning operation is explained. In addition, since it is the same as that of the operation gestalt 1 about circulation of the refrigerant in the operation gestalt 2, explanation of operation is omitted. If some gas refrigerants of elevated-temperature high pressure breathed out by open [of the 1st two way valve 13] from the compressor 1 are led to the 1st bypass way 12, it will go into a receiver 11 through a capillary tube 14. At this time, heat exchange of the gas refrigerant of elevated-temperature high pressure which entered in the receiver 11 is carried out to the gas refrigerant of low-

temperature low voltage in an accumulator 6 by the dashboard 18, it turns into a high-pressure liquid cryogen, and is stored as a surplus refrigerant.

[0022] In addition, when a refrigerating cycle becomes insufficient [a refrigerant] also in this operation gestalt, the 2nd two way valve 17 is changed into an open condition, and an accumulator 6 is supplemented with the surplus refrigerant stored in the receiver 11.

[0023] thus -- since the pars basilaris ossis occipitalis of an accumulator 6 was caudad extended as a dashboard 18 and the receiver 11 was formed, there is no high low voltage heat exchanger 15 -- ** -- it is effective in the ability to cool the gas refrigerant of elevated-temperature high pressure which goes via the 1st bypass way 12.

[0024] Operation gestalt 3. drawing 4 is the block diagram concerning the operation gestalt 3 of this invention showing the refrigerating cycle of an air conditioner, for example, and shows the condition at the time of air conditioning operation. In addition, the sign same identically to the operation gestalt 1 explained by drawing 1 as a considerable part is attached, and explanation is omitted.

[0025] It is the 2nd temperature sensor which detects the temperature T_c of the refrigerant which 21 is attached in piping which connects a compressor 1 and a four way valve 2 in drawing, and the center section of the outdoor heat exchanger 3 which operates as a condenser is equipped with the 1st temperature sensor which detects the temperature T_d of the gas refrigerant of elevated-temperature high pressure breathed out from the compressor 1, and 22, and is cooled by the outdoor heat exchanger 3.

[0026] 31 for example, in case it is the control circuit which controls the compressor 1 grade of an air conditioner, and it has the 1st valve-control means of this invention, for example, the amount of the surplus refrigerant at the time of air conditioning operation is adjusted Subtract the detection temperature T_c of the 2nd temperature sensor 22 from the detection temperature T_d of the 1st temperature sensor 21, and it asks for the regurgitation degree of superheat SHd. And the lower limit of the 1st allowed value of the degree of superheat SHd and the regurgitation degree of superheat set up beforehand is compared. When the regurgitation degree of superheat SHd is below the lower limit of the 1st allowed value, the 1st two way valve 13 is changed into an open condition through the valve drive circuit 32, and when the regurgitation degree of superheat SHd exceeds the lower limit of the 1st allowed value, the 1st two way valve 13 is made into a closed state.

[0027] Moreover, at the time of steady operation, said regurgitation degree of superheat SHd and upper limit of the 1st allowed value are compared, when the regurgitation degree of superheat SHd exceeds the upper limit of the 1st allowed value, the 2nd two way valve 17 is changed into an open condition through the valve drive circuit 32, and when the regurgitation degree of superheat SHd is below the upper limit of the 1st allowed value, the 2nd two way valve 17 is made into a closed state. In addition, the 1st and 2nd two way valves 13 and 17 mentioned above consist of a solenoid valve.

[0028] Next, actuation of the refrigerating cycle constituted as mentioned above is explained based on drawing 5 . Drawing 5 is a flow chart concerning the operation gestalt 3 which shows actuation of the refrigerating cycle of an air conditioner, for example. In addition, since it is the same as the operation gestalt 1 about actuation of each part when circulating the above-mentioned non-azeotropy mixing refrigerant, explanation is omitted.

[0029] If a compressor 1 is started, a control circuit 31 will change the 1st two way valve 13 into an open condition through the valve drive circuit 32, and will begin operation which stores a surplus refrigerant in a receiver 11. First, the temperature T_c of the two phase refrigerant in an outdoor heat exchanger 3 is inputted through the 2nd temperature sensor 22, and, subsequently the temperature T_d of the gas refrigerant of elevated-temperature high pressure breathed out from the compressor 1 is inputted through the 1st temperature sensor 21. And the detection temperature T_c of the 2nd temperature sensor 22 is subtracted from the detection temperature T_d , and it asks for the regurgitation degree of superheat SHd, and the lower limit of the degree of superheat SHd and the 1st allowed value of the regurgitation degree of superheat set up beforehand is compared.

[0030] Since the lower limit of the 1st allowed value is higher than the regurgitation degree of

superheat SHd, the open condition of the 1st two way valve 13 is held at the time of a start up, and it starts the input of the detection temperature Tc of the 2nd temperature sensor 22, and the detection temperature Td of the 1st temperature sensor 21 again. If the refrigerant in an accumulator 6 is lost, the intake air temperature of a compressor 1 rises and the regurgitation degree of superheat SHd based on the detection temperature Tc and the detection temperature Td exceeds the lower limit of the 1st allowed value while repeating this actuation and performing it, the 1st two way valve 13 will be made into a closed state through the valve drive circuit 32, and the reservoir of the surplus refrigerant to a receiver 11 will be ended.

[0031] During steady operation, said regurgitation degree of superheat SHd and upper limit of the 1st allowed value are compared, and when the regurgitation degree of superheat SHd is below the upper limit of the 1st allowed value, the closed state of the 2nd two way valve 17 is maintained. Moreover, although said regurgitation degree of superheat SHd increases when operational status changes with change of an OAT, an air-conditioning load, etc. and a circulation refrigerant is insufficient, with the lack of a refrigerant, when the regurgitation degree of superheat SHd exceeds the upper limit of the 1st allowed value, the 2nd two way valve 17 is changed into an open condition, and the surplus refrigerant currently stored by the receiver 11 is supplied to an accumulator 6. And when the regurgitation degree of superheat SHd becomes below the upper limit of the 1st allowed value by this supply, the 2nd two way valve 17 is made into a closed state.

[0032] As mentioned above, according to the operation gestalt 3, when a compressor 1 is started, the 1st two way valve 13 is changed into an open condition. Subtract the detection temperature Tc of the 2nd temperature sensor 22 from the detection temperature Td of the 1st temperature sensor 21, and it asks for the regurgitation degree of superheat SHd. And the lower limit of the 1st allowed value of the degree of superheat SHd and the regurgitation degree of superheat set up beforehand is compared. When the regurgitation degree of superheat SHd is below the lower limit of the 1st allowed value, hold the open condition of the 1st two way valve 13, and the reservoir of the surplus refrigerant to a receiver 11 is continued. Since the closed state of the 1st two way valve 13 is carried out and it was made to stop the reservoir when the regurgitation degree of superheat SHd exceeded the lower limit of the 1st allowed value. It is effective in the ability to suppress small presentation change of the refrigerant which can store in a receiver 11 certainly, without accumulating a surplus refrigerant in an accumulator 6 even if service conditions, such as an OAT and piping extension, change, therefore circulates through a refrigerating cycle.

[0033] Moreover, at the time of steady operation, when said regurgitation degree of superheat SHd exceeds the upper limit of the 1st allowed value, change the 2nd two way valve 17 into an open condition, and the surplus refrigerant in the SHIBA 11 is supplied to an accumulator 6. Since the 2nd two way valve 17 is made into a closed state and it was made to stop the supply when the regurgitation degree of superheat SHd became below the upper limit of the 1st allowed value, even if it becomes insufficient [a refrigerant] during operation, it is effective in it being cancelable.

[0034] In addition, although the 1st and 2nd temperature sensors 21 and 22 were attached in the predetermined location and control of a surplus refrigerant was explained to the refrigerating cycle of the operation gestalt 1, it prepares in the refrigerating cycle which shows these 1st and 2nd temperature sensors 21 and 22 to the 2nd operation gestalt, and you may make it control a surplus refrigerant by the operation gestalt 3.

[0035] Operation gestalt 4. drawing 6 is the block diagram concerning the operation gestalt 4 of this invention showing the refrigerating cycle of an air conditioner, for example, and shows the condition at the time of air conditioning operation. In addition, the sign same identically to the operation gestalt 3 explained by drawing 4 as a considerable part is attached, and explanation is omitted.

[0036] It is attached in the inlet side of a compressor 1, the center section of the 3rd temperature sensor 23 which detects the temperature Ts of the gas refrigerant of low-temperature low voltage inhaled by the compressor 1, and the indoor heat exchanger 5 which operates as an evaporator is equipped, and the refrigerating cycle of this operation gestalt is

equipped with the 4th temperature sensor 24 which detects the temperature T_e of the refrigerant evaporated by indoor heat exchanger 5.

[0037] Moreover, in case a control circuit 31 is equipped with the 2nd valve-control means of this invention, for example, the amount of the surplus refrigerant at the time of air conditioning operation is adjusted Subtract the detection temperature T_e of the 4th temperature sensor 22 from the detection temperature T_s of the 3rd temperature sensor 21, and it asks for the inhalation degree of superheat SHs. And the lower limit of the 2nd allowed value of the degree of superheat SHs and the inhalation degree of superheat set up beforehand is compared. When the inhalation degree of superheat SHs is below the lower limit of the 2nd allowed value, the 1st two way valve 13 is changed into an open condition through the valve drive circuit 32, and when the inhalation degree of superheat SHs exceeds the lower limit of the 2nd allowed value, the 1st two way valve 13 is made into a closed state.

[0038] At the time of steady operation, when said inhalation degree of superheat SHs exceeds the upper limit of the 2nd allowed value, the 2nd two way valve 17 is changed into an open condition through the valve drive circuit 32, and when the inhalation degree of superheat SHs is below the upper limit of the 2nd allowed value, the 2nd two way valve 17 is made into a closed state. In addition, the 2nd allowed value of this operation gestalt is set as the operation gestalt 3 lower than the 1st allowed value of a publication.

[0039] Next, actuation of the refrigerating cycle constituted as mentioned above is explained based on drawing 7. Drawing 7 is a flow chart concerning the operation gestalt 4 which shows actuation of the refrigerating cycle of an air conditioner, for example. In addition, since it is the same as the operation gestalt 1 about actuation of each part when circulating the above-mentioned non-azeotropy mixing refrigerant, explanation is omitted.

[0040] If a compressor 1 is started, a control circuit 31 will change the 1st two way valve 13 into an open condition through the valve drive circuit 32, as mentioned above, and will begin operation which stores a surplus refrigerant in a receiver 11. First, the temperature T_e of the two phase refrigerant in indoor heat exchanger 5 is inputted through the 4th temperature sensor 24, and, subsequently to a compressor 1, the temperature T_s of the gas refrigerant of low-temperature low voltage inhaled is inputted through the 3rd temperature sensor 23. And the detection temperature T_e of the 4th temperature sensor 24 is subtracted from the detection temperature T_s , and it asks for the inhalation degree of superheat SHs, and the lower limit of the degree of superheat SHs and the 2nd allowed value of the inhalation degree of superheat set up beforehand is compared.

[0041] Since the lower limit of the 2nd allowed value is higher than the inhalation degree of superheat SHs, the open condition of the 1st two way valve 13 is held at the time of a start up, and it starts the input of the detection temperature T_s of the 3rd temperature sensor 23, and the detection temperature T_e of the 4th temperature sensor 24 again. If the refrigerant in an accumulator 6 is lost, the intake air temperature of a compressor 1 rises and the inhalation degree of superheat SHs based on the detection temperature T_e and the detection temperature T_s exceeds the lower limit of the 2nd allowed value while repeating this actuation and performing it, the 1st two way valve 13 will be made into a closed state through the valve drive circuit 32, and the reservoir of the surplus refrigerant to a receiver 11 will be ended.

[0042] During steady operation, said inhalation degree of superheat SHs and upper limit of the 2nd allowed value are compared, and when the inhalation degree of superheat SHs is below the upper limit of the 2nd allowed value, the closed state of the 2nd two way valve 17 is maintained. Moreover, although said inhalation degree of superheat SHs increases when operational status changes with change of an OAT, an air-conditioning load, etc. and a circulation refrigerant is insufficient, with the lack of a refrigerant, when the inhalation degree of superheat SHs exceeds the upper limit of the 2nd allowed value, the 2nd two way valve 17 is changed into an open condition, and the surplus refrigerant currently stored by the receiver 11 is supplied to an accumulator 6. And when the inhalation degree of superheat SHs becomes below the upper limit of the 2nd allowed value by this supply, the 2nd two way valve 17 is made into a closed state.

[0043] As mentioned above, according to the operation gestalt 4, when a compressor 1 is started, the 1st two way valve 13 is changed into an open condition. Subtract the detection

temperature T_e of the 4th temperature sensor 24 from the detection temperature T_s of the 3rd temperature sensor 23, and it asks for the inhalation degree of superheat SHs. And the lower limit of the 2nd allowed value of the degree of superheat SHs and the inhalation degree of superheat set up beforehand is compared. When the inhalation degree of superheat SHs is below the lower limit of the 2nd allowed value, change the 1st two way valve 13 into an open condition, and the reservoir of the surplus refrigerant to a receiver 11 is continued. Since the closed state of the 1st two way valve 13 is carried out and it was made to stop the reservoir when the inhalation degree of superheat SHs exceeded the lower limit of the 2nd allowed value It is effective in the ability to suppress small presentation change of the refrigerant which can store in a receiver 11 certainly, without accumulating a surplus refrigerant in an accumulator 6 even if service conditions, such as an OAT and piping extension, change, therefore circulates through a refrigerating cycle.

[0044] Moreover, at the time of steady operation, when said inhalation degree of superheat SHs exceeds the upper limit of the 2nd allowed value, change the 2nd two way valve 17 into an open condition, and the surplus refrigerant in a receiver 11 is supplied to an accumulator 6. Since the 2nd two way valve 17 is made into a closed state and it was made to stop the supply when the inhalation degree of superheat SHs became below the upper limit of the 2nd allowed value, even if it becomes insufficient [a refrigerant] during operation, it is effective in it being cancelable.

[0045] In addition, although the 3rd and 4th temperature sensors 23 and 24 were attached in the predetermined location and control of a surplus refrigerant was explained to the refrigerating cycle of the operation gestalt 1 as mentioned above, it prepares in the refrigerating cycle which shows these 3rd and 4th temperature sensors 23 and 24 to the 2nd operation gestalt, and you may make it control a surplus refrigerant by the operation gestalt 4.

[0046]

[Effect of the Invention] Since it is made to go via the 1st bypass way, it cools and some gas refrigerants of elevated-temperature high pressure breathed out from the compressor 1 were stored in the receiver according to this invention as mentioned above, it can become possible to lose the surplus refrigerant in an accumulator, presentation change of the refrigerant which circulates through a refrigerating cycle can also be suppressed small, and fluctuation of working pressure or capacity etc. can be prevented. Moreover, since the refrigerant inhaled by the compressor by losing the surplus refrigerant in an accumulator is certainly gasifiable, the effectiveness of a compressor becomes good and it is effective in COP of a refrigerating cycle improving.

[0047] moreover -- since the pars basilaris ossis occipitalis of an accumulator was caudad extended as a dashboard and the receiver was formed, in addition to said effectiveness, there is no heat exchanger -- ** -- it is effective in the ability to cool the gas refrigerant of elevated-temperature high pressure which goes via the 1st bypass way.

[0048] Furthermore, form the 1st temperature sensor in the discharge side of a compressor, and the 2nd temperature sensor is formed in a condenser, respectively. The difference of the detection temperature of the 1st temperature sensor and the detection temperature of the 2nd temperature sensor is calculated. And since the value was compared with the 1st allowed value set up beforehand, and it was made to change the 1st two way valve into the open condition when said value was below a lower limit of the 1st allowed value It is effective in the ability to suppress small presentation change of the refrigerant which can store in a receiver certainly, without accumulating a surplus refrigerant in an accumulator even if service conditions, such as an OAT and piping extension, change, therefore circulates through a refrigerating cycle. Moreover, since the 2nd two way valve is changed into an open condition and the surplus refrigerant in the SHIBA was supplied to the accumulator when said value exceeded the upper limit of the 1st allowed value, even if it becomes insufficient [a refrigerant] during operation, it is effective in it being cancelable.

[0049] Form the 3rd temperature sensor in the inlet side of a compressor, and the 4th temperature sensor is formed in an evaporator further again, respectively. The difference of the detection temperature of the 3rd temperature sensor and the detection temperature of the 4th temperature sensor is calculated. And since the value was compared with the 2nd allowed value

set up beforehand, and it was made to change the 1st two way valve into the open condition when said value was below a lower limit of the 1st allowed value. It is effective in the ability to suppress small presentation change of the refrigerant which can store in a receiver certainly, without accumulating a surplus refrigerant in an accumulator even if service conditions, such as an OAT and piping extension, change, therefore circulates through a refrigerating cycle. Moreover, since the 2nd two way valve is changed into an open condition and the surplus refrigerant in the SHIBA was supplied to the accumulator when said value exceeded the upper limit of the 2nd allowed value, even if it becomes insufficient [a refrigerant] during operation, it is effective in it being cancelable.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram concerning the operation gestalt 1 of this invention showing the refrigerating cycle of an air conditioner, for example.

[Drawing 2] It is the comparison Fig. of presentation change of the circulation refrigerant when storing a non-azeotropy mixing refrigerant in a receiver and an accumulator.

[Drawing 3] It is the block diagram concerning the operation gestalt 2 of this invention showing the refrigerating cycle of an air conditioner, for example.

[Drawing 4] It is the block diagram concerning the operation gestalt 3 of this invention showing the refrigerating cycle of an air conditioner, for example.

[Drawing 5] It is the flow chart concerning the operation gestalt 3 which shows actuation of the refrigerating cycle of an air conditioner, for example.

[Drawing 6] It is with the block diagram concerning the operation gestalt 4 of this invention showing the refrigerating cycle of an air conditioner, for example.

[Drawing 7] It is the flow chart concerning the operation gestalt 4 which shows actuation of the refrigerating cycle of an air conditioner, for example.

[Drawing 8] It is the block diagram showing the refrigerating cycle of the conventional air conditioner.

[Description of Notations]

1 Compressor 2 Four Way Valve 3 Outdoor Heat Exchanger 4 Collimator, 5 Indoor heat exchanger 6 Accumulator 11 Receiver, 12 1st bypass way 13 The 1st two way valve 14 Capillary tube, 15 A quantity low voltage heat exchanger, 16 2nd bypass way 17 The 2nd two way valve, 21 The 1st thermo sensor 22 The 2nd temperature sensor 23 The 3rd thermo sensor 24 The 4th temperature sensor 31 A control circuit, 32 Valve drive circuit.

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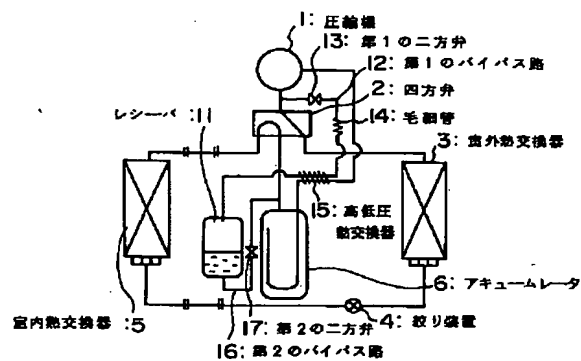
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(54) 【発明の名称】 冷凍サイクル

(57) 【要約】

【課題】 非共沸混合冷媒を用いても、余剰冷媒による循環冷媒の組成の変動を抑制でき、かつ、COPを向上させる冷凍サイクルを提供する。

【解決手段】 第1の二方弁13及び冷媒流量を調整する毛細管14が設けられ、圧縮機1と四方弁2をつなぐ配管とレシーバ11とを接続する第1のバイパス路12と、圧縮機1に吸入されるアキュムレータ6からの低圧の非共沸混合冷媒と第1のバイパス路12内を通る高温高圧の前記冷媒とを熱交換をする高低圧熱交換器15と、第2の二方弁17が設けられ、レシーバ11とアキュムレータ6とを接続する第2のバイパス路16とを備えた。



【特許請求の範囲】

【請求項1】 沸点の異なる2種類以上の冷媒からなる非共沸混合冷媒を高温高圧化し、四方弁、凝縮器、絞り装置、蒸発器及びアキュムレータを順に介して循環させる圧縮機と、

レシーバと、

第1の二方弁及び冷媒流量を調整する毛細管が設けられ、前記圧縮機と四方弁をつなぐ配管と前記レシーバとを接続する第1のバイパス路と、

前記圧縮機に吸入されるアキュムレータからの低圧の前記冷媒と前記第1のバイパス路内を通る高温高圧の前記冷媒とを熱交換をする熱交換器と、

第2の二方弁が設けられ、前記レシーバとアキュムレータとを接続する第2のバイパス路とを有することを特徴とする冷凍サイクル。

【請求項2】 前記レシーバは、前記アキュムレータの底部を仕切板として下方に延びて形成されていることを特徴とする請求項1記載の冷凍サイクル。

【請求項3】 前記圧縮機の吐出側に設置された第1の温度センサと、

前記凝縮器に設置された第2の温度センサと、

前記第1の温度センサの検知温度と前記第2の温度センサの検知温度との差を演算し、かつ、その値と予め設定された第1の許容値とを比較し、前記値が第1の許容値の下限值以下のときは前記第1の二方弁を開状態にし、前記値が第1の許容値の上限値を越えたときは前記第2の二方弁を開状態にする第1の弁制御手段とを備えていることを特徴とする請求項1又は2のいずれかに記載の冷凍サイクル。

【請求項4】 前記圧縮機の吸入側に設置された第3の温度センサと、

前記蒸発器に設置された第4の温度センサと、

前記第3の温度センサの検知温度と前記第4の温度センサの検知温度との差を演算し、かつ、その値と予め設定された第2の許容値とを比較し、前記値が第2の許容値の下限值以下のときは前記第1の二方弁を開状態にし、前記値が第2の許容値の上限値を越えたときは前記第2の二方弁を開状態にする第2の弁制御手段とを備えていることを特徴とする請求項1又は2のいずれかに記載の冷凍サイクル。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、沸点の異なる2種類以上の冷媒からなる非共沸混合冷媒を封入した空気調和機等の冷凍サイクルに関するものである。

【0002】

【従来の技術】 図8は従来の空気調和機の冷凍サイクルを示すブロック図であり、図において、1はアキュムレータ6内の低温低圧のガス冷媒を吸入して圧縮し高温高圧のガス冷媒にする圧縮機、2は四方弁、3は凝縮器

として動作する室外熱交換器、4は絞り装置、5は蒸発器として動作する室内熱交換器である。

【0003】 前記のように構成された従来の空気調和機の冷凍サイクルにおいては、例えば冷房運転の場合、圧縮機1より高温高圧のガス冷媒が吐出し、四方弁2を通して室外熱交換器3に入る。このガス冷媒は室外熱交換器により外気と熱交換されて液状の冷媒となり絞り装置4に入る。液化された冷媒は、絞り装置4によって減圧され、乾き度の低い二相冷媒となって室内熱交換器5に送り込まれる。そして、室内熱交換器5で室内の空気と熱交換されて蒸発し、乾き度の高い二相冷媒となって四方弁2、アキュムレータ6を経由し、再び圧縮機1に吸入される。この時、アキュムレータ6には冷媒回路内で余った余剰冷媒が貯留される。

【0004】

【発明が解決しようとする課題】 前記のような従来の冷凍サイクルにおいて、例えばR（フロン）134aを52重量%、R125を25重量%、R32を23重量%の比率で混合した非共沸混合冷媒を用いた場合、アキュムレータ6に貯留される余剰冷媒の中で低沸点冷媒であるR32、R125が多くガス化し易いため、冷凍サイクル中を循環する冷媒は低沸点冷媒であるR32、R125が多めの組成となり、アキュムレータ6に貯留される余剰冷媒の量が増加した場合、冷凍サイクル中を循環する冷媒の組成も変化してしまい、このことから循環冷媒の物性が変動したり、動作圧力や能力の変動等が生じていた。

【0005】 また、混合冷媒の非共沸性により、従来から用いられてきたR22等の単一冷媒と比べ熱交換器配管内の熱伝達率が小さくなることが知られており、これにより冷凍サイクルのCOP（効率）が低下するという課題もあった。

【0006】 本発明は、かかる課題を解決するためになされたもので、非共沸混合冷媒を用いても、余剰冷媒による循環冷媒の組成の変動を抑制でき、かつ、COPを向上させる冷凍サイクルを提供することを目的とする。

【0007】

【課題を解決するための手段】 本発明に係る冷凍サイクルは、沸点の異なる2種類以上の冷媒からなる非共沸混合冷媒を高温高圧化し、四方弁、凝縮器、絞り装置、蒸発器及びアキュムレータを順に介して循環させる圧縮機と、レシーバと、第1の二方弁及び冷媒流量を調整する毛細管が設けられ、前記圧縮機と四方弁をつなぐ配管と前記レシーバとを接続する第1のバイパス路と、前記圧縮機に吸入されるアキュムレータからの低圧の前記冷媒と前記第1のバイパス路内を通る高温高圧の前記冷媒とを熱交換をする熱交換器と、第2の二方弁が設けられ、前記レシーバとアキュムレータとを接続する第2のバイパス路とを有したものである。

【0008】 前記レシーバは、前記アキュムレータの

底部を仕切板として下方に延びて形成されたものである。

【0009】また、前記圧縮機の吐出側に設置された第1の温度センサと、前記凝縮器に設置された第2の温度センサと、前記第1の温度センサの検知温度と前記第2の温度センサの検知温度との差を演算し、かつ、その値と予め設定された第1の許容値とを比較し、前記値が第1の許容値の下限值以下のときは前記第1の二方弁を開状態にし、前記値が第1の許容値の上限値を越えたときは前記第2の二方弁を開状態にする第1の弁制御手段とを備えたものである。

【0010】さらに、前記圧縮機の吸入側に設置された第3の温度センサと、前記蒸発器に設置された第4の温度センサと、前記第3の温度センサの検知温度と前記第4の温度センサの検知温度との差を演算し、かつ、その値と予め設定された第2の許容値とを比較し、前記値が第2の許容値の下限值以下のときは前記第1の二方弁を開状態にし、前記値が第2の許容値の上限値を越えたときは前記第2の二方弁を開状態にする第2の弁制御手段とを備えたものである。

【0011】

【発明の実施の形態】実施形態1. 図1は本発明の実施形態1に係る例えば空気調和機の冷凍サイクルを示すブロック図で、冷房運転時の状態を示している。なお、図8で説明した従来と同一又は相当部分には同じ符号を付し説明を省略する。

【0012】図において、11はレシーバ、12は圧縮機1と四方弁2とをつなぐ配管から分岐してレシーバ11に接続された第1のバイパス路、13は第1のバイパス路12を開閉する第1の二方弁、14は第1のバイパス路12に流れる高温高圧のガス冷媒の量を調整する毛細管、15は圧縮機1に吸入される低温低圧のガス冷媒と第1のバイパス路12内を通る高温高圧のガス冷媒とを熱交換をする高低圧熱交換器、16はアキュムレータ6の入口配管から分岐してレシーバ11の底部に接続された第2のバイパス路、17は第2のバイパス路16を開閉する第2の二方弁である。なお、本実施形態に用いられている冷媒は、沸点の異なる2種類以上の冷媒からなる非共沸混合冷媒である。

【0013】前記のように構成された冷凍サイクルにおいて冷房運転時の動作を説明する。なお、運転開始時、第1の二方弁が開状態になっているものとする。圧縮機1より高温高圧のガス冷媒が吐出し、四方弁2を通過して室外熱交換器3に入る。このガス冷媒は室外熱交換器3により外気と熱交換されて液状の冷媒となり絞り装置4に入る。液化された冷媒は絞り装置4によって減圧され、乾き度0.2~0.3の低温低圧の二相冷媒となって室内熱交換器5に送り込まれる。そして、室内熱交換器5で室内の空気と熱交換されて蒸発し、乾き度0.9~1.0の低温低圧の二相冷媒となって四方弁2、アキ

ュームレータ6を経由し、再び圧縮機1に吸入される。

【0014】一方、圧縮機1から吐出された高温高圧のガス冷媒の一部は、第1の二方弁13の開により第1のバイパス路12の方へ流れて毛細管14を通り、さらに、高低圧熱交換器15を通りながら圧縮機1に吸入される低温低圧のガス冷媒と熱交換され、即ち、冷却されて高圧の液体冷媒となりレシーバ11に余剰冷媒として貯留される。

【0015】ここで、図2に基づいて余剰冷媒の組成変化について説明する。図2は非共沸混合冷媒をレシーバとアキュムレータに貯留したときの循環冷媒の組成変化の比較図である。図8に示す従来のような冷凍サイクルのアキュムレータ6に余剰の非共沸混合冷媒を溜めるようにした場合は、その混合冷媒が低圧であるため組成変化が大きくなってしまい（イ参照）。これに対して、本実施形態の場合は、レシーバ11内に高温の余剰混合冷媒（液状）を貯留しているので、冷凍サイクルを循環するその混合冷媒の組成変化が小さくなる（ロ参照）。

【0016】なお、定常運転中に外気温度や空調負荷等の変化により運転状態が変化して冷媒不足となった場合には、第2の二方弁17を開状態にし、レシーバ11内に貯留された余剰冷媒をアキュムレータ6に補給する。

【0017】以上のように実施形態1によれば、圧縮機1から吐出された高温高圧のガス冷媒の一部、即ち余剰冷媒を第1のバイパス路12を経由させて冷却しレシーバ11に貯留するようにしたので、アキュムレータ6内の余剰冷媒をなくすることが可能になり、冷凍サイクルを循環する冷媒の組成変化も小さく抑えることができ、動作圧力や能力の変動などを防止することができる。

【0018】また、アキュムレータ6内の余剰冷媒をなくすることにより圧縮機1に吸入される冷媒を確実にガス化することができるので、圧縮機1の効率がよくなり、かつ、冷凍サイクルのCOPが向上するという効果がある。

【0019】実施形態2. 図3は本発明の実施形態2に係る例えば空気調和機の冷凍サイクルを示すブロック図で、冷房運転時の状態を示している。なお、図1で説明した実施形態1と同一又は相当部分には同じ符号を付し説明を省略する。

【0020】実施形態2においては、レシーバ11がアキュムレータ6の底部を仕切板18として下方に延びて形成され、この仕切板18は、レシーバ11に導かれた高温高圧のガス冷媒をアキュムレータ6内の低温低圧のガス冷媒と熱交換するためのものである。アキュムレータ6とレシーバ11は第2のバイパス路16によって接続され、レシーバ11は、圧縮機1と四方弁2を結ぶ配管に第1のバイパス路12を介して接続されている。この第1のバイパス路12には第1の二方弁13と

毛細管14が設けられ、第2にバイパス路16には第2の二方弁17が取り付けられている。

【0021】次に冷房運転時の動作を説明する。なお、実施形態2における冷媒の循環については実施形態1と同様であるため動作の説明を省略する。第1の二方弁13の開により圧縮機1から吐出された高温高压のガス冷媒の一部が第1のバイパス路12に導かれると、毛細管14を通してレシーバ11に入る。この時、レシーバ11内に入った高温高压のガス冷媒は、仕切板18によりアキュムレータ6内の低温低压のガス冷媒と熱交換されて高压の液体冷媒となり、余剰冷媒として貯留される。

【0022】なお、本実施形態においても冷凍サイクルが冷媒不足となった場合には、第2の二方弁17を開状態にし、レシーバ11内に貯留された余剰冷媒をアキュムレータ6に補充する。

【0023】このように、レシーバ11を、アキュムレータ6の底部を仕切板18として下方に延ばして形成したので、高低圧熱交換器15が無くとも第1のバイパス路12を経由する高温高压のガス冷媒を冷却できると

いう効果がある。
【0024】実施形態3。図4は本発明の実施形態3に係る例えば空気調和機の冷凍サイクルを示すブロック図で、冷房運転時の状態を示している。なお、図1で説明した実施形態1と同一又は相当部分には同じ符号を付し説明を省略する。

【0025】図において、21は圧縮機1と四方弁2とを結ぶ配管に取り付けられ、圧縮機1より吐出された高温高压のガス冷媒の温度Tdを検知する第1の温度センサ、22は凝縮器として動作する室外熱交換器3の中央部に装着され、室外熱交換器3により冷却される冷媒の温度Tcを検知する第2の温度センサである。

【0026】31は例えば空気調和機の圧縮機1等を制御する制御回路で、本発明の第1の弁制御手段を備え、例えば冷房運転時の余剰冷媒の量を調整する際は、第1の温度センサ21の検知温度Tdから第2の温度センサ22の検知温度Tcを減算して吐出過熱度SHdを求め、かつ、その過熱度SHdと予め設定された吐出過熱度の第1の許容値の下限值とを比較し、吐出過熱度SHdが第1の許容値の下限值以下のときは弁駆動回路32を通じて第1の二方弁13を開状態にし、吐出過熱度SHdが第1の許容値の下限値を越えたときは第1の二方弁13を閉状態にする。

【0027】また、定常運転時は、前記吐出過熱度SHdと第1の許容値の上限値とを比較し、その吐出過熱度SHdが第1の許容値の上限値を越えたとき弁駆動回路32を通じて第2の二方弁17を開状態にし、吐出過熱度SHdが第1の許容値の上限値以下のときは第2の二方弁17を閉状態にする。なお、前述した第1及び第2の二方弁13、17は、例えば電磁弁からなっている。

【0028】次に、前記のように構成された冷凍サイクルの動作を図5に基づいて説明する。図5は実施形態3に係る例えば空気調和機の冷凍サイクルの動作を示すフローチャートである。なお、前述の非共沸混合冷媒を循環させるときの各部の動作については実施形態1と同じであるため説明を省略する。

【0029】制御回路31は、圧縮機1を起動すると、弁駆動回路32を通じて第1の二方弁13を開状態にし、レシーバ11内に余剰冷媒を貯留する運転を始める。まず、第2の温度センサ22を通して室外熱交換器3内の二相冷媒の温度Tcを入力し、次いで、圧縮機1より吐出された高温高压のガス冷媒の温度Tdを第1の温度センサ21を介して入力する。そして、その検知温度Tdから第2の温度センサ22の検知温度Tcを減算して吐出過熱度SHdを求め、かつ、その過熱度SHdと予め設定された吐出過熱度の第1の許容値の下限值とを比較する。

【0030】運転開始時は吐出過熱度SHdより第1の許容値の下限值の方が高いので、第1の二方弁13の開状態を保持し、再び、第2の温度センサ22の検知温度Tcと第1の温度センサ21の検知温度Tdの入力に入る。この動作を繰り返し行っていくうちにアキュムレータ6内の冷媒がなくなり、圧縮機1の吸入温度が上昇して検知温度Tcと検知温度Tdとに基づく吐出過熱度SHdが第1の許容値の下限値を越えると、弁駆動回路32を通じて第1の二方弁13を閉状態にし、レシーバ11への余剰冷媒の貯留を終了する。

【0031】定常運転中は前記吐出過熱度SHdと第1の許容値の上限値とを比較し、その吐出過熱度SHdが第1の許容値の上限値以下のときは第2の二方弁17の閉状態を維持する。また、外気温度や空調負荷等の変化により運転状態が変化して循環冷媒が不足状態となった場合は前記吐出過熱度SHdが増加するが、その冷媒不足により、吐出過熱度SHdが第1の許容値の上限値を越えたときは第2の二方弁17を開状態にし、レシーバ11に貯留されている余剰冷媒をアキュムレータ6に補給する。そして、この補給により吐出過熱度SHdが第1の許容値の上限値以下になったときに第2の二方弁17を閉状態にする。

【0032】以上のように実施形態3によれば、圧縮機1を起動したとき第1の二方弁13を開状態にし、そして、第1の温度センサ21の検知温度Tdから第2の温度センサ22の検知温度Tcを減算して吐出過熱度SHdを求め、かつ、その過熱度SHdと予め設定された吐出過熱度の第1の許容値の下限值とを比較し、吐出過熱度SHdが第1の許容値の下限值以下のときは第1の二方弁13の開状態を保持してレシーバ11への余剰冷媒の貯留を継続し、吐出過熱度SHdが第1の許容値の下限値を越えたときは第1の二方弁13を閉状態にしてその貯留を停止するようにしたので、外気温度や配管延長等

の運転条件が変化しても余剰冷媒をアキュムレータ6に溜めることなく確実にレシーバ11内に貯留することができ、そのため、冷凍サイクルを循環する冷媒の組成変化を小さく抑えることができるという効果がある。

【0033】また、定常運転時は、前記吐出過熱度SHdが第1の許容値の上限値を越えたとき第2の二方弁17を開状態にしてレシーバ11内の余剰冷媒をアキュムレータ6に補給し、吐出過熱度SHdが第1の許容値の上限値以下になったときに第2の二方弁17を閉状態にしてその補給を停止するようにしたので、運転中に冷媒不足となってもそれを解消できるという効果もある。

【0034】なお、実施形態3では、実施形態1の冷凍サイクルに第1及び第2の温度センサ21、22を所定位置に取り付けて余剰冷媒の制御について説明したが、この第1及び第2の温度センサ21、22を第2の実施形態に示す冷凍サイクルに設けて余剰冷媒を制御するようにしてもよい。

【0035】実施形態4、図6は本発明の実施形態4に係る例えば空気調和機の冷凍サイクルを示すブロック図で、冷房運転時の状態を示している。なお、図4で説明した実施形態3と同一又は相当部分には同じ符号を付し説明を省略する。

【0036】本実施形態の冷凍サイクルには、圧縮機1の吸入側に取り付けられ、圧縮機1により吸入される低温低圧のガス冷媒の温度Tsを検知する第3の温度センサ23と、蒸発器として動作する室内熱交換器5の中央部に装着され、室内熱交換器5により気化される冷媒の温度Teを検知する第4の温度センサ24とが備えられている。

【0037】また、制御回路31は、本発明の第2の弁制御手段を備え、例えば冷房運転時の余剰冷媒の量を調整する際は、第3の温度センサ21の検知温度Tsから第4の温度センサ22の検知温度Teを減算して吸入過熱度SHsを求め、かつ、その過熱度SHsと予め設定された吸入過熱度の第2の許容値の下限值とを比較し、吸入過熱度SHsが第2の許容値の下限值以下のときは弁駆動回路32を通じて第1の二方弁13を開状態にし、吸入過熱度SHsが第2の許容値の下限值を越えたときは第1の二方弁13を閉状態にする。

【0038】定常運転時は、前記吸入過熱度SHsが第2の許容値の上限値を越えたとき弁駆動回路32を通じて第2の二方弁17を開状態にし、吸入過熱度SHsが第2の許容値の上限値以下のときは第2の二方弁17を閉状態にする。なお、本実施形態の第2の許容値は、実施形態3に記載の第1の許容値より低く設定されている。

【0039】次に、前記のように構成された冷凍サイクルの動作を図7に基づいて説明する。図7は実施形態4に係る例えば空気調和機の冷凍サイクルの動作を示すフ

ローチャートである。なお、前述の非共沸混合冷媒を循環させるときの各部の動作については実施形態1と同じであるため説明を省略する。

【0040】制御回路31は、圧縮機1を起動すると、前述したように弁駆動回路32を通じて第1の二方弁13を開状態にし、レシーバ11内に余剰冷媒を貯留する運転を始める。まず、第4の温度センサ24を通して室内熱交換器5内の二相冷媒の温度Teを入力し、次いで、圧縮機1に吸入される低温低圧のガス冷媒の温度Tsを第3の温度センサ23を介して入力する。そして、その検知温度Tsから第4の温度センサ24の検知温度Teを減算して吸入過熱度SHsを求め、かつ、その過熱度SHsと予め設定された吸入過熱度の第2の許容値の下限值とを比較する。

【0041】運転開始時は吸入過熱度SHsより第2の許容値の下限值の方が高いので、第1の二方弁13の開状態を保持し、再び、第3の温度センサ23の検知温度Tsと第4の温度センサ24の検知温度Teの入力に入る。この動作を繰り返し行っていくうちにアキュムレータ6内の冷媒が無くなり、圧縮機1の吸入温度が上昇して検知温度Teと検知温度Tsとに基づく吸入過熱度SHsが第2の許容値の下限值を越えると、弁駆動回路32を通じて第1の二方弁13を閉状態にし、レシーバ11への余剰冷媒の貯留を終了する。

【0042】定常運転中は前記吸入過熱度SHsと第2の許容値の上限値とを比較し、その吸入過熱度SHsが第2の許容値の上限値以下のときは第2の二方弁17の閉状態を維持する。また、外気温度や空調負荷等の変化により運転状態が変化して循環冷媒が不足状態となった場合は前記吸入過熱度SHsが増加するが、その冷媒不足により、吸入過熱度SHsが第2の許容値の上限値を越えたときは第2の二方弁17を開状態にし、レシーバ11に貯留されている余剰冷媒をアキュムレータ6に補給する。そして、この補給により吸入過熱度SHsが第2の許容値の上限値以下になったときに第2の二方弁17を閉状態にする。

【0043】以上のように実施形態4によれば、圧縮機1を起動したとき第1の二方弁13を開状態にし、そして、第3の温度センサ23の検知温度Tsから第4の温度センサ24の検知温度Teを減算して吸入過熱度SHsを求め、かつ、その過熱度SHsと予め設定された吸入過熱度の第2の許容値の下限值とを比較し、吸入過熱度SHsが第2の許容値の下限值以下のときは第1の二方弁13を開状態にしてレシーバ11への余剰冷媒の貯留を継続し、吸入過熱度SHsが第2の許容値の下限值を越えたときは第1の二方弁13を閉状態にしてその貯留を停止するようにしたので、外気温度や配管延長等の運転条件が変化しても余剰冷媒をアキュムレータ6に溜めることなく確実にレシーバ11内に貯留することができ、そのため、冷凍サイクルを循環する冷媒の組成変化

を小さく抑えることができるという効果がある。

【0044】また、定常運転時は、前記吸入過熱度SHsが第2の許容値の上限値を越えたとき第2の二方弁17を開状態にしてレシーバ11内の余剰冷媒をアキュムレータ6に補給し、吸入過熱度SHsが第2の許容値の上限値以下になったときに第2の二方弁17を開状態にしてその補給を停止するようにしたので、運転中に冷媒不足となってもそれを解消できるという効果もある。

【0045】なお、実施形態4では、前述したように実施形態1の冷凍サイクルに第3及び第4の温度センサ23、24を所定位置に取り付けて余剰冷媒の制御について説明したが、この第3及び第4の温度センサ23、24を第2の実施形態に示す冷凍サイクルに設けて余剰冷媒を制御するようにしてもよい。

【0046】

【発明の効果】以上のように本発明によれば、圧縮機1から吐出された高温高圧のガス冷媒の一部を第1のバイパス路を経由させて冷却しレシーバに貯留するようにしたので、アキュムレータ内の余剰冷媒をなくすことが可能になり、冷凍サイクルを循環する冷媒の組成変化も小さく抑えることができ、動作圧力や能力の変動などを防止することができる。また、アキュムレータ内の余剰冷媒をなくすことにより圧縮機に吸入される冷媒を確実にガス化することができるので、圧縮機の効率がよくなり、かつ、冷凍サイクルのCOPが向上するという効果がある。

【0047】また、レシーバを、アキュムレータの底部を仕切板として下方に延ばして形成したので、前記効果に加え熱交換器が無くとも第1のバイパス路を経由する高温高圧のガス冷媒を冷却できるという効果がある。

【0048】さらに、圧縮機の吐出側に第1の温度センサを、凝縮器に第2の温度センサをそれぞれ設けて、第1の温度センサの検知温度と第2の温度センサの検知温度との差を演算し、かつ、その値と予め設定された第1の許容値とを比較し、前記値が第1の許容値の下限値以下のときは第1の二方弁を開状態にするようにしたので、外気温度や配管延長等の運転条件が変化しても余剰冷媒をアキュムレータに溜めることなく確実にレシーバ内に貯留することができ、そのため、冷凍サイクルを循環する冷媒の組成変化を小さく抑えることができるという効果がある。また、前記値が第1の許容値の上限値を越えたときは第2の二方弁を開状態にしてレシーバ内の余剰冷媒をアキュムレータに補給するようにしたので、運転中に冷媒不足となってもそれを解消できると

いう効果もある。

【0049】さらにまた、圧縮機の吸入側に第3の温度センサを、蒸発器に第4の温度センサをそれぞれ設けて、第3の温度センサの検知温度と第4の温度センサの検知温度との差を演算し、かつ、その値と予め設定された第2の許容値とを比較し、前記値が第1の許容値の下限値以下のときは第1の二方弁を開状態にするようにしたので、外気温度や配管延長等の運転条件が変化しても余剰冷媒をアキュムレータに溜めることなく確実にレシーバ内に貯留することができ、そのため、冷凍サイクルを循環する冷媒の組成変化を小さく抑えることができるという効果がある。また、前記値が第2の許容値の上限値を越えたときは第2の二方弁を開状態にしてレシーバ内の余剰冷媒をアキュムレータに補給するようにしたので、運転中に冷媒不足となってもそれを解消できるという効果もある。

【図面の簡単な説明】

【図1】 本発明の実施形態1に係る例えば空気調和機の冷凍サイクルを示すブロック図である。

【図2】 非共沸混合冷媒をレシーバとアキュムレータに貯留したときの循環冷媒の組成変化の比較図である。

【図3】 本発明の実施形態2に係る例えば空気調和機の冷凍サイクルを示すブロック図である。

【図4】 本発明の実施形態3に係る例えば空気調和機の冷凍サイクルを示すブロック図である。

【図5】 実施形態3に係る例えば空気調和機の冷凍サイクルの動作を示すフローチャートである。

【図6】 本発明の実施形態4に係る例えば空気調和機の冷凍サイクルを示すブロック図である。

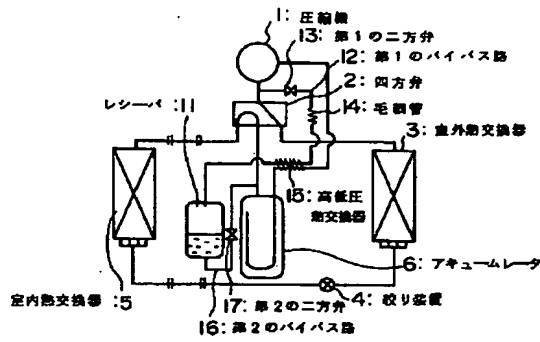
【図7】 実施形態4に係る例えば空気調和機の冷凍サイクルの動作を示すフローチャートである。

【図8】 従来の空気調和機の冷凍サイクルを示すブロック図である。

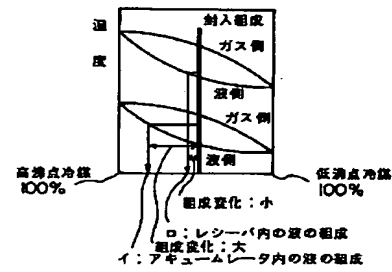
【符号の説明】

1 圧縮機、 2 四方弁、 3 室外熱交換器、 4 絞り装置、 5 室内熱交換器、 6 アキュムレータ、 11 レシーバ、 12 第1のバイパス路、 13 第1の二方弁、 14 毛細管、 15 高低圧熱交換器、 16 第2のバイパス路、 17 第2の二方弁、 21 第1の温度センサー、 22 第2の温度センサ、 23 第3の温度センサー、 24 第4の温度センサ、 31 制御回路、 32 弁駆動回路。

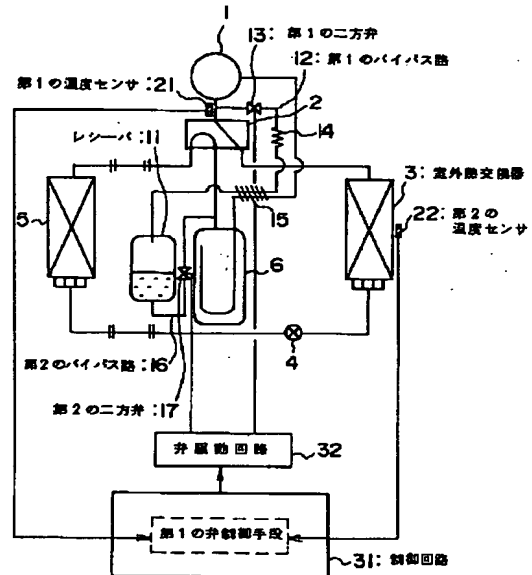
【図1】



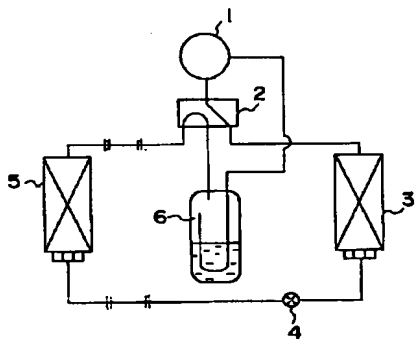
【図2】



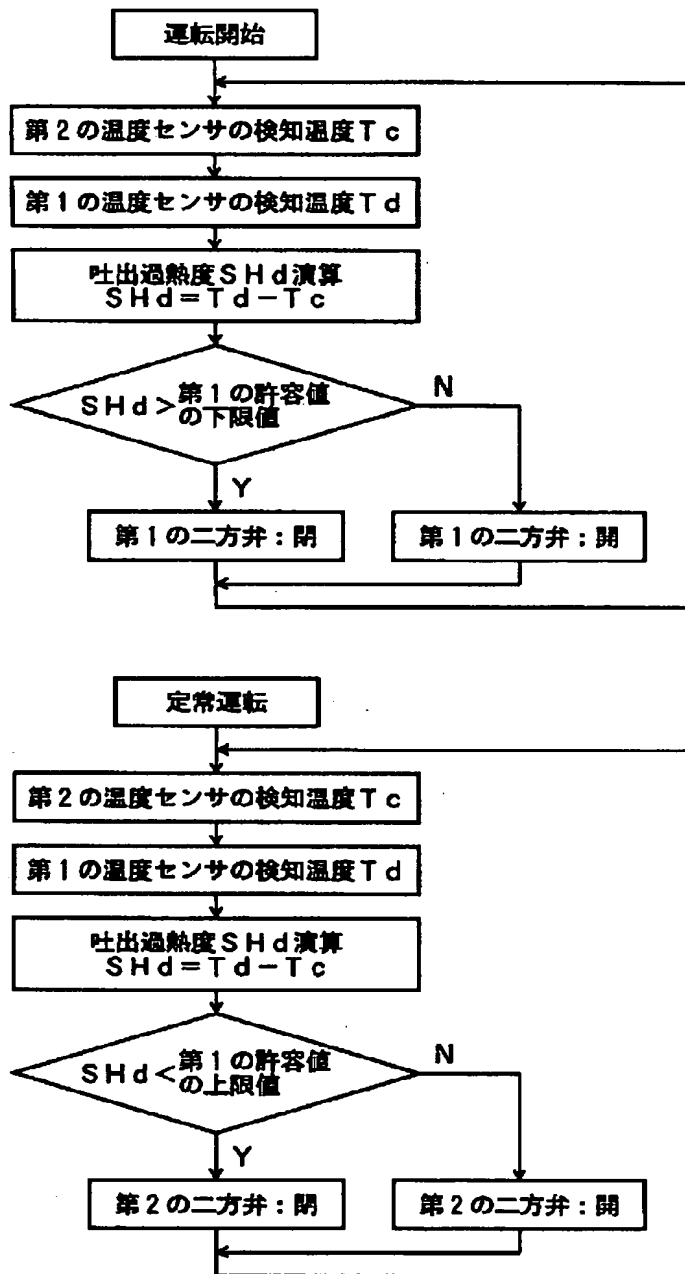
【図4】



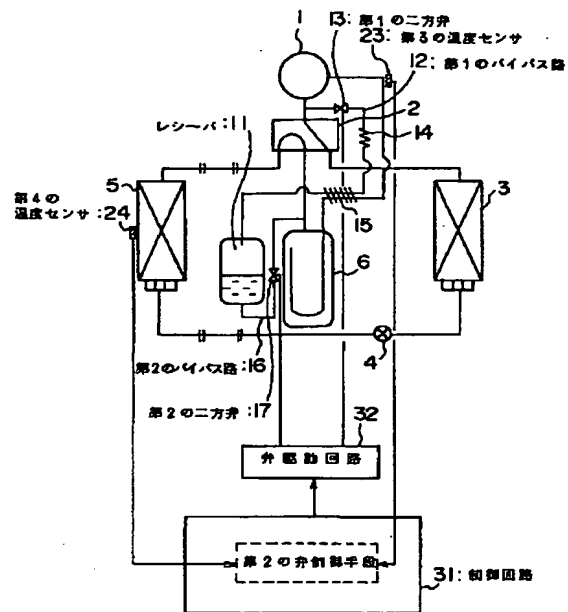
【図8】



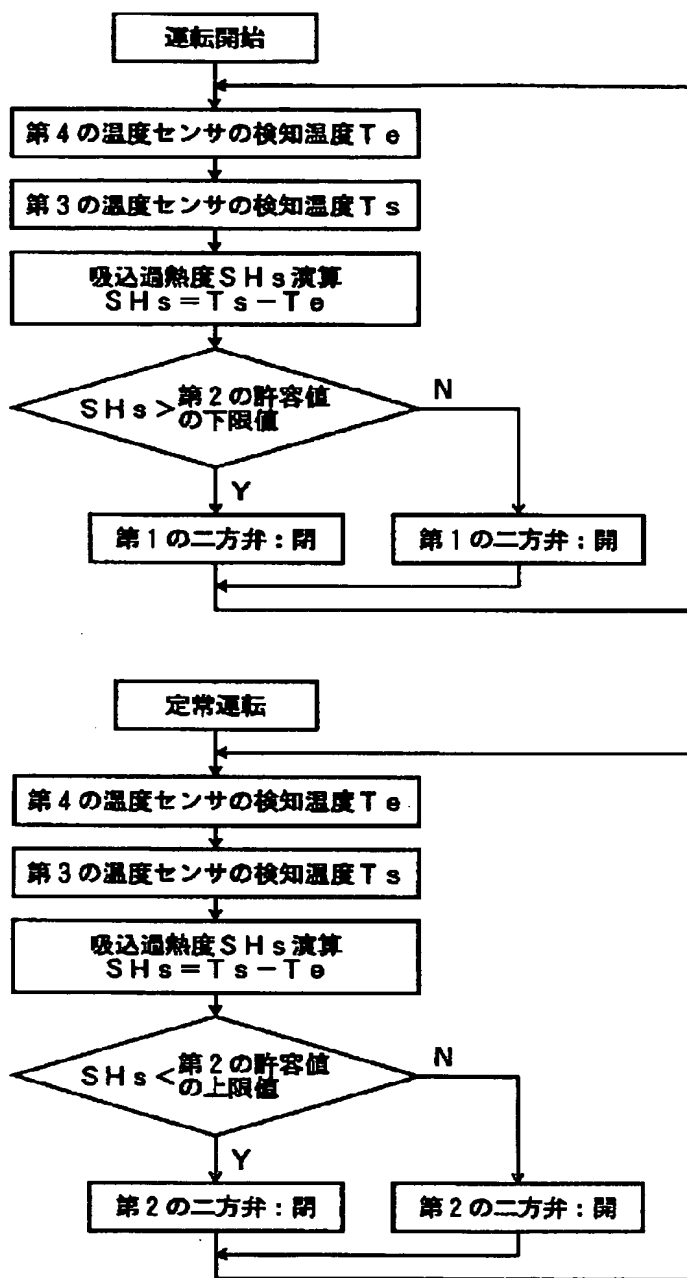
【図5】



【図6】



【図7】



フロントページの続き

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